

Meeting Summary Comments
Red Hill Bulk Fuel Storage Facility Subject Matter Expert Meeting

May 10-12, 2016
Hawaii Department of Health
919 Ala Moana Blvd., Honolulu, HI

Attendee List

The company name "Exponent" is misspelled in the Attendee List.

Tuesday, May 10, 2016 - Sections 6 & 7

- 1) Regulatory Agencies requested correction to: "Solid and Hazardous Waste Branch and Safe Drinking Water Branch (DOH)"
- 5) *The Navy submitted a Monitoring Well Installation Work Plan in April 2016 and requested comments from the Regulatory Agencies by May 25, 2016 to expedite field activities for drilling and installing the on-base wells currently targeted to be in July 2016.*

BWS requested the following clarifications:

- a) It should be noted that this work plan was submitted on April 26, 2016 and BWS was not made aware of the document until April 27, 2016. Minimal time was allowed for the BWS and the other subject matter experts to review the monitoring well installation plan prior to the AOC meeting on May 10, 2016.
 - b) Commander B. Vogel reported that there were 70 repair locations in Tank 5 that failed the vacuum box testing.
- 10) *The BWS is concerned that there is uncertainty regarding the presence or absence of valley fill between Red Hill and Halawa Shaft.*
- a. *The Navy commented that there are several references of previous studies suggesting the presence of valley fill in the area.*

BWS requested correction:

- a) The BWS stated that there is no direct evidence that valley fill in Halawa valley intersects the basal aquifer and affects groundwater flow between Red Hill and Halawa shaft and that these references

the Navy refers too also state that the extent and depth of valley fill is unknown. Previous Navy reports assumed valley fill impedes groundwater flow from Red Hill to Halawa shaft, whereas the recent United States Geological Survey (USGS) pump test at Halawa shaft showed drawdown at Red Hill wells and the USGS (2005) groundwater model showed equally good fits to the observed heads whether valley fill units were simulated as impeding flow in the basal aquifer or not. Navy's consultant, AECOM, acknowledged that there is uncertainty about the valley fill in South and North Halawa Valleys. BWS is also concerned that the Navy's Red Hill Fuel Facility diminishing BWS's ability to develop future potable drinking water wells in this area.

11) The BWS is concerned that the groundwater flow is questionable and undefined and additional monitoring wells are needed to characterize groundwater flow.

a. The Navy responded that it has recently installed two monitoring wells and four additional wells are planned to be installed during 2016-2017.

BWS requested correction:

The BWS stated that there is too much uncertainty about groundwater flow rates and directions in the area surrounding Red Hill, Halawa Shaft, and Moanalua wells and that additional monitoring wells and a monitoring program are needed. The BWS also recommended that the monitoring program include installing transducers immediately with data loggers in all wells to understand how heads change with time and to record daily or hourly pumping rates at Red Hill shaft, and report them to understand how pumping affects groundwater heads at those wells.

The BWS also stated that an additional four monitoring wells is a good start but more monitoring wells will be needed.

12) The BWS is especially concerned about groundwater flow from the Red Hill towards the Halawa Shaft. The Navy indicated that existing wells and four new proposed wells should help confirm if there is a groundwater flow component towards Halawa Shaft.

a. The Navy stated the proposed monitoring wells are expected to assist in determining whether valley fill intersects the ground water aquifer and in addressing potential pathways to groundwater along the eastern, southern, and western boundaries of the Red Hill

Facility (that currently do not have monitoring wells) to better define groundwater flow directions.

- b. The Navy further noted that this investigation takes a phased approach, and as results are received, data will be evaluated at that time to determine the next steps.*

BWS requested correction after a. above:

The BWS asked for an explanation about how a single new monitoring well between Red Hill and Halawa shaft will provide enough information to understand groundwater flow between Red Hill and Halawa shaft.

- 14) *The BWS stated that elevated water use occurs during summer and the months immediately following summer (e.g., September and October) and suggested that those months may not be optimal for aquifer testing (e.g., pump tests).*

BWS requested correction:

Replace "suggested" with "stated".

- 15) *The Navy plans to resurvey all monitoring wells using established benchmarks. The USGS suggested that the topographic survey should be a conducted as a first order survey.*

BWS requested correction after the first sentence:

The BWS stated that the resurvey was necessary before the groundwater head measurements could be used to determine groundwater flow or to recalibrate the numerical flow model. The BWS also stated that any resurveying of monitoring wells be coordinated with USGS, as they already surveyed almost all of the subject wells using the National Geodetic Survey.

- 16) *The BWS indicated plans to install a monitoring well close to Navy monitoring well, RHMW09, and suggested that the Navy relocate RHMW09 to a location northeast of the Red Hill Facility to investigate potential groundwater flow in that direction. BWS also mentioned that recent efforts to contract the well installation were unsuccessful.*

BWS requested correction:

The BWS indicated plans to install a monitoring well close to the Navy's proposed RHMW09 and suggested that the Navy relocate RHMW09 to a location north or northwest of the Red Hill facility to investigate groundwater flow in that direction because of fuel

contaminant detections in the CWRM deep monitoring well, RHMW06, and RHMW04. This location will also potentially yield more information pertaining to valley fill. BWS also mentioned that recent efforts to contract the well installation required a re-bid.

- 17) *The Navy questioned whether groundwater flow in that direction was likely and stated that the four agreed-upon monitoring well locations should be prioritized. No decision on this suggestion was made during the meeting.*

BWS requested correction:

While no decision on this suggestion was made during the meeting, the Navy indicated it would strongly consider changing the location of RHMW09.

Navy Response: RHMW09 will be install at the original location.

- 21) *The BWS suggested evaluating the breakdown products of fuel and the valence states of compounds that may result from the degradation process.*

BWS requested correction:

The BWS recommended measuring compounds derived from fuel degradation, as well as compounds that indicate degradation is occurring.

- 22) *The BWS questioned why the Chemicals of Potential Concern (COPC) list had been reduced.*
- a. The Navy noted that the current COPC list is appropriate because it is based on fuel types that have been stored at Red Hill, previous environmental investigations, historical sampling results, and regulatory guidance / DOH Technical Guidance Manual for middle distillates). Additional information for the basis of the COPC list can be found in the Work Plan/Scope of Work.*

BWS requested clarification:

EPA indicated during the discussion that they would consider updating the COPC list should new information (either sampling data or fuel additive list) indicate that additional COPCs need to be added. BWS reiterated its position that reducing the COPC list is premature.

- 23) *The BWS suggested that more evaluations of the vadose zone are necessary as infiltrating rainfall from above Red Hill may move the LNAP L (light non-*

aqueous phase liquid) to groundwater. The BWS requested more vapor monitoring points and noted that vapor monitoring points may be able to indicate the presence of LNAPL.

BWS requested correction:

The BWS stated that more investigation and characterization of the vadose zone is needed to understand where LNAPL is located and to track its migration. The BWS pointed out that the 10 – 25 inches per year of infiltrating rainwater demonstrate that there is vertical movement of liquids through the basalt vadose zone. The BWS also stated that successfully carrying out the remedial alternative screening task will require either knowledge about the locations, and possible migration rates of LNAPL in the vadose zone, otherwise the screening will be based on only assumed locations and migration rates.

- 24) *The Navy stated that due to the highly heterogeneous nature of the vadose zone underlying the Red Hill Facility, soil vapor readings may not provide actionable data or necessarily indicate reliable locations of LNAPL if present.*

BWS requested correction:

In response the BWS pointed out that the existing soil vapor points are located beneath the 20-foot-thick concrete pad that underlies each tank and yet they show fuel vapors are changing in time even though the fuel is not migrating through the concrete.

- 25) *Environmental Protection Agency (EPA) responded that the concern and focus is with LNAPL present at the groundwater table, as it very difficult to characterize the vadose zone around Red Hill due to the highly heterogeneous nature of the vadose zone underlying the Red Hill Facility and other site limitations. It is on this basis that the Parties of the AOC currently plan to take a more conservative approach of modeling with the assumption of hypothetical amounts of LNAPL already present on the groundwater table interface versus modeling a less conservative scenario that considers the unpredictable, heterogeneous nature of the vadose zone.*

BWS requested correction:

In response, the BWS pointed out that such conservative assumptions cannot be legitimately applied to estimate degradation rates of fuel contaminants in the aquifer.

- 26) *The Navy noted that, due to the heterogeneity and anisotropic nature of the hydrogeology, using average values of hydraulic properties in a vadose zone model would not be representative of site conditions and would not be*

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reproducible.

BWS requested correction:

In response the BWS strongly disagreed with this position and restated the importance of vadose zone investigation.

- 27) *The DLNR requested that future monitoring well borings may encounter LNAPL (if present) in the vadose zone be considered for conversion to extraction points rather than abandoned.*

BWS requested correction:

Add, DLNR felt that there could be a lot of fuel in the vadose zone and questioned if this could be remediated.

- 28) The USGS commented that the modeling should acknowledge the variability in the groundwater flow evaluations. The Navy should consider that specified heads on the boundaries of the model can overestimate recharge, and a no-flow boundary on the model can underestimate salt water intrusion.

USGS commented:

USGS cautioned that groundwater models of the Red Hill area that rely on specified-head boundaries may inadvertently create a source of water if modeled pumping conditions change relative to those assumed for model calibration. This will affect modeled flow directions.

- 29) There was question on the utility of monitoring well, RHMW07.
- a. The Navy stated that RHMW07 provides valuable information input for the overall conceptual site model for the Red Hill Facility (i.e., may be screened with a very low permeability layer such as a dike complex) and will be included in the synoptic water level survey planned later in the investigation.

USGS commented:

Unclear why this is under "USGS remarks" section.

- 30) The USGS stated that other sources of uncertainty in the modeling would include the use of Type (1) prescribed head, Type (2) prescribed flux, or Type (3) head dependent flux boundaries. These uncertainties should be considered during the modeling effort. The USGS also suggested that the accuracy of the model could be improved if the limits of the model were extended to known geological boundaries.

USGS commented:

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USGS indicated that model boundaries are best extended to geological boundaries, although this may cause the modeled area to expand geographically.

EPA would like to add:

- 31) USGS stated that during a recent drinking water pump test in the area a response was detected on the east side of the Halawa Valley Fills.
- 32) During the discussion of the chemistry of RHMW04, USGS stated that the detection of COPCs should be considered evidence that the groundwater could flow from the Facility to the northwest.
- 33) USGS noted that the bottom boundary of the groundwater flow model is not static and will change with the proposed increased pumping rate scenarios.
- 34) USGS suggested that it is best to move the lateral boundaries of the groundwater flow model to boundaries with known hydraulic characteristics.
- 35) USGS recommended that the Navy conduct a plumbness survey of the wells being used to support the groundwater flow modeling

Wednesday, May 11, 2016 - Sections 2, 3, 4 and 5

- 1) Regulatory Agencies requested correction to: "Solid and Hazardous Waste Branch and Safe Drinking Water Branch (DOH)"

- 8) Regulatory Agencies commented:

During a visit to view Tank #5 in July 2014, a Navy contractor did inform EPA staff that fuel had leaked into the tank after a hole had been drilled through the steel plating.

Will the Navy be removing the patch plates and plugging the holes and then replacing the patch plates for Tank 5?

- 10) Regulatory Agencies requested that the sentence *should be revised to read "observable corrosion" or "visible corrosion"*

- 20) *Many factors can lead to a weld defect, e.g., incomplete welding, weld cracking, improper electrode, porosity, inappropriate amount of heat, and hydrogen cracking. These factors have implications for past welding.*

a. Navy response: There are no cracks in the welds. Rather, one hole in one weld in Tank 5 was not plugged. The welding procedure was correct, but the contractor's Quality Control (QC) was inappropriate (there was supposed to be a person other than the welder to conduct a visual test and dye-penetration test). The defects are in the process of being repaired. All weld patches that have been removed were not inspected. On six tanks, the Navy has not had any major issues on welding. The Navy plans on conducting destructive testing (DT) to investigate welding chemistry and the metal's chemical composition.

BWS requested correction:

The Navy stated that holes were drilled to check for explosive vapors behind the tank were not filled or plugged prior to welding patch plates in Tank 5. Lengthy discussion about the merits of filling holes prior to welding. Navy stated that procedure going forward would include filling holes prior to welding.

Regulatory agencies request clarification:

You mentioned that one hole in one weld was not plugged. However, Commander Vogel stated that there were 70 defective welds. This needs clarification.

- 29) *The BWS contracted SME posed one of the questions from its 25 April 2016*

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BWS letter regarding calculation of the Corrosion Rate. The letter recommends using the Tank 16 plate that has full penetration as a suggestion for calculating wall loss.

- a. *NAVFA EWXC responded, indicating that the calculation process is dynamic and will be improved as more cumulative information is known from more tank inspections. The intent is to use corrosion rates that are representative of the tanks overall and not necessarily the extremes. It was pointed out that a figure included in the Corrosion and Metal Fatigue Practices Report illustrates that corrosion anomalies are a small percentage of the total surface, and use of the Tank 16 plate may not be representative of the tanks.*

BWS requested clarification:

The BWS stated that not using the corroded section of steel plate from Tank 16 to calculate wall loss is not conservative or safe in determining corrosion rates.

- 31) *BWS next reiterated its concern from its 25 April 2016 BWS letter that the weld defects may be due to fatigue.*

BWS requested correction:

This statement is inaccurate and not what was stated by BWS. BWS asked "why the Navy thought fatigue was an issue."

Navy recommend the following language change for better clarification:

"During discussions regarding the 25 April 2016 BWS letter that the weld defects may be due to fatigue, BWS asked "why the Navy thought that fatigue was an issue?" Both NAVFAC EXWC and EPA SMEs explained that there is not enough a cyclical load in the tanks for fatigue to be an issue. Weld defects are in part due to the quality of welders available during original construction of the tanks."

- 43) Regulatory Agencies requested correction:

EPA's consultants explained that simply scaling up technologies that have been routinely applied to smaller tanks (10,000 – 20,000 gallons), such as secondary containment of tanks, is no guarantee that the technology would be suitable or successful in the tanks as large as the ones at Red Hill the difficulty in scaling-up and applying the double walling used on small tanks (10,000 gallons) to such large tanks, such as those at Red Hill. Installing double wall tanks has twice as much surface area and twice as much corrosion. Double wall piping can result in a constant state of false alarms, which is not acceptable. The double wall decision has to be made as an engineering decision and not a common sense decision as double walling of tanks as large as the Red Hill tanks is very

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complicated. Ultimately, when all the numbers and risks are calculated, a human decision must be made

46) Regulatory Agencies requested correction:

Under Section 4, leak detection sensitivity is not always better. A more sensitive leak detection system could results in more false positive alarms, which could causes operators to ~~not believe~~ disregard the alarms. There is an optimum sensitivity that does not originate too many false alarms but also informs the operators of potential leaks. An evaluation of how much fuel could leak before the operator's receive an alarm must be factored into the risk assessment (Section 8).

50) *It was recommended by EPA that the Navy should retain removed steel plates from the Red Hill Tanks for future evaluation.*

BWS requested clarification:

The BWS also recommended that the Navy should retain removed steel plates from the Red Hill Tanks for future evaluation.

52) *EPA asked if tank nozzles are being considered.*

BWS requested clarification:

The BWS also asked if tank nozzles are being considered. EPA stated that the AOC does not cover the over three miles of fuel piping in the Lower Access Tunnel to Pearl Harbor. It covers a short section of piping (i.e. nozzle) at the bottom of each tank into the Lower Access Tunnel. BWS stated that the AOC should cover the piping from the Tanks to Pearl Harbor and the entire fuel storage facility.

BWS recommended that another tank alternative be considered, the complete relocation of the fuel stored at the Red Hill facility to other locations.

Thursday, May 12, 2016 - Section 8

- 1) Regulatory Agencies requested correction to: "Solid and Hazardous Waste Branch and Safe Drinking Water Branch (DOH)"
- 4) The Powers Engineering, Inc. American Petroleum Institute (API) 653 inspector stated that based on the engineering drawings they would classify these tanks as engineered concrete tanks with a steel liner. The historical drawings outline the efforts taken during construction with the 4 feet thick concrete base and the 1.5 feet thick concrete around the tanks. These Red Hill Tanks are more in line with a nuclear industry tank than a normal concrete tank. Also based on the reports available the tanks are in compliance with API 653 now.

Regulatory Agencies requested clarification:

EPA's understanding of the basic tank structure, which is based on Navy written materials as well as conversations with Navy personnel, is that each tank sits atop a 20 ft. thick concrete base and that the concrete surrounding the steel tapers from 4 ft. thick at the base of the tank barrel to about 1.5 – 2 feet thick at the top of the tank barrel.

BWS asks that the following be added to the meeting notes:

- 14) BWS stated that "acceptable risk" levels need to be defined. The "acceptable risk" has not been provided to the contractors performing the risk analysis. For any risk assessment to be valid, the parties must determine what level or risk is acceptable (and what level of risk is NOT acceptable), and which failure scenarios to consider.
- 15) BWS stated that "acceptable risk" target levels should be jointly defined by the parties, and all Stakeholders before commencing the risk assessments. The agreed upon level should provide an acceptable target likelihood for tank rupture/leak, as well as acceptable volumes of fuel released by such rupture/leaks, and acceptable concentrations of fuel in the groundwater.
- 16) BWS stated that the question remains as to whether the risk assessment is only for the tanks in their as-is condition, or it's meant to incorporate planned upgrades and/or other leak mitigation activities. BWS recommended that both should be done because this will allow a comparison of risk between the various alternatives.
- 17) BWS recommended the Navy perform a Safety Integrity Level (SIL) assessment or a Layers of Protection Analysis (LOPA) of the tank system's interlocks/alarms. This SIL/LOPA will assess the need for automatic

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emergency shutdown valves on pipelines and minimize leak severity.

Include risks associated with the Red Hill pipe supports/racking; earthquake-induced ruptures from Diesel, JP-5 and JP-8 pipeline into the tunnel; seismic rupture of water pipeline and subsequent impact to fuel pipelines; leak/rupture of small bore pipelines (sampling lines); tank leak/rupture; tank overfill/spill; fire; maintenance accident; human factors (incorrect operation); sabotage (internal/external)

- 18) BWS recommended assessing costs associated with contamination of the aquifer. Consider how the costs are affected by volume of leaked fuel, location of the leak.
- 19) BWS led a discussion on Level 1, Level 2, Level 3 and Level 4 Risk assessments:
 - Level 1 – Tank/Pipe Leak scenario evaluations
 - Level 2 – Release of petroleum hydrocarbons to Environment (release rates, volumes)
 - Level 3 – Fate and transport to water aquifer
 - Level 4 – Human health impact from contaminated water

EPA stated that the AOC does not require conducting a human health effects study.
- 20) Navy/EPA indicated that they plan to perform up to Level 3 risk assessments for all alternatives. Level 4 was not being considered.
- 21) The BWS stressed the need to compare the risk levels between the current storage location and alternative locations.
- 22) The BWS stated that the risk assessment should be used to determine which of the alternatives provide the optimum decrease in risk. BWS recommended using a cost-benefit analysis to determine the best ALARP (as low as reasonably practicable) risk solution.